Does Customary Land Tenure System Encourage Local Forestry Management in Zambia? A Focus on Wood Fuel

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May 2015

Indaba Agricultural Policy Research Institute (IAPRI)
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The views expressed or remaining errors and omissions are solely the responsibility of the authors.

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EXECUTIVE SUMMARY

Zambia is one of the most forested countries in Africa, with about 50 million out of the 75 million hectares total land area under some form of forest cover. However, the country also has one of the highest rates of deforestation and degradation in the world, estimated at 250,000-300,000 hectares of forest loss per annum. Reversing/slowing this high deforestation and degradation trend will require the country to design and implement programs and strategies that will effectively deal with both the proximate and underlying drivers of deforestation and degradation. A precondition to designing such programs and strategies is a clear identification and understanding of the main drivers of deforestation, both proximate and underlying. Implementing such programs and strategies is important to help the country contribute to climate change mitigation efforts, and benefit from international climate mitigation initiatives such as the UN-REDD programme[1] *inter alia*.

While the evidence is compelling that charcoal and firewood (collectively referred to as wood fuel) is one of the major drivers of deforestation and degradation, there appears to be an under-appreciation of the role of customary land institutions in wood fuel production and/or marketing, and forest management in general. Customary land administration systems, in which forestry management systems are embedded, guide the daily management and consumption and/or use of land resources including forests. Further, land tenure directly determines who has the right to benefit from forests and who has duties to protect it. While it is important to identify and address the population drivers of wood fuel production and/or marketing, what is even more important is understanding the institutional arrangements, which provide user rules, and rights, as well as enforcement and sanctions/penalties for rule-breakers. Thus, it is critical that local land and forest management institutions form an integral part of analyses concerning local forest management.

With over two thirds of the country's total forest area on customary land and only about 24% under state land, traditional authorities have a significant role to play in reducing wood fuel production, and deforestation and/or degradation in general. Therefore, understanding forestry management institutions under customary land administration systems can provide insights into how such systems can be leveraged to reduce deforestation and degradation from wood fuel production and/or marketing, and help promote sustainable local forest management.

Against this backdrop, this paper has three research objectives. First, we examine the socioeconomic factors that influence rural household participation in wood fuel[2] production and/or marketing. Second, we explore what local forest management interventions have been designed by customary land administrators and their local communities. Third, we assess the effectiveness of local forest management institutions in curbing deforestation.

In this study, we use a mixed methods approach—quantitative and qualitative methods—to address the overarching question whether the customary land tenure system encourages or discourages local forestry management in Zambia. The data are drawn from nationally

[1] The United Nations Framework Convention on Climate Change (UNFCCC) developed the *"Reducing Emissions from Deforestation and Forest Degradation plus other interventions"* (REDD+) mechanism to provide financial incentives to reduce such emissions. REDD+ includes *"Reducing Emissions from Deforestation and Forest Degradation"* (initially referred to as REDD) as well as: i) conservation of indigenous forests; ii) sustainable management of forests; and iii) the enhancement of forest carbon stocks.

[2] In this study, wood fuel refers to both charcoal and firewood as in Zulu and Richardson (2013).

representative household survey data, and information from focus group discussions and key informant interviews.

Our results reveal that household and community level determinants of wood fuel production and/or marketing are mostly associated with poverty, unemployment, and rising demand for wood fuel, and wood fuel market access. With rural poverty rates of about 80% in Zambia, high unemployment and the increasing demand for wood fuel, particularly charcoal in urban areas, wood fuel production, and/or marketing will continue to rise. Holding everything else constant, our results indicate that high landholding size, value of assets, and agricultural productivity reduce the likelihood of household participation in wood fuel production and/or marketing. Furthermore, we find that male headed households are more likely to participate in wood fuel production and/or marketing, perhaps because of the drudgery of the activities involved in charcoal production. With regards to institutions, our results indicate weak, and mostly informal local forestry management institutions in customary areas, with very limited enforcement. The combination of weak institutions, poverty, unemployment and rising demand for wood fuel, presents the forest (wood fuel) as an important alternative source of livelihood, leading to deforestation and degradation. Results from FGDs, key informant interviews and in-depth interviews indicate that local forestry management institutions in their current state (informal rules, lack of enforcement structures) do not work, and fail to internalize the costs of forest resource depletion, rendering the existing institutions ineffective. Although poverty, agricultural productivity, and unemployment feature prominently in forest conservation interventions, such interventions will have very limited impact on forest outcome if local forestry management institutions remain informal, with very limited enforcement.

Based on the major findings and conclusions drawn from the analyses we make the following recommendations:

- As local forestry management institutions play a crucial role in local forestry management, forest conservation strategies and programs need to facilitate formalization and strengthening of existing local forestry management institutions. This is in line with the revised National Forestry Policy of 2014 which prioritizes the establishment of a framework that supports traditional leadership and communities to develop local level rules and regulations to facilitate effective management of forest resources.
- Rural development strategies need to ramp up rural employment creation to help shift labor away from wood fuel production and/or marketing. As in many other African countries, Zambia is experiencing rapid youth population growth dubbed *youth bulge.* Many of these young people will be seeking employment or business opportunities. However, in the absence of such opportunities, wood fuel and mostly charcoal, will most likely remain one of the important sources of livelihood for the majority rural youth.
- There is need to address both financial and human resources constraints in the Forestry Department (FD), especially at district level in order to improve forestry extension service provision on sustainable forestry management to local communities.
- With the support of FD, customary land administrators and their communities should formalize, and where necessary amend the existing rules to respond to emerging economic and structural changes, such as rising urban demand for charcoal, rural population growth, unemployment, and poverty.

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ACRONYMS AND ABBREVIATIONS

CBD	Convention on Biological Diversity group
CHAPOSA	Charcoal Potential in Southern Africa
CIFOR	Center for International Forestry Research
CSO	Central Statistical Office
FAO	Food and Agriculture Organization
FD	Forestry Department
FGDs	Focus Group Discussions
FISP	Farmer Input Support Program
FRA	Food Reserve Agency
GRZ	Government of the Republic of Zambia
ha	Hectare
HCI	Household Commercialization Index
IAD	Institutional Analysis and Development
IAPRI	Indaba Agricultural Policy Research Institute
ILUA	Integrated Land Use Assessment
IPCC	Intergovernmental Panel on Climate Change
JFM	Joint Forestry Management
MAL	Ministry of Agricultural and Livestock
RALS	Rural Agricultural Livelihood Survey
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	Reducing Emissions from Deforestation and Forest Degradation plus other interventions
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wide Fund for Nature

1. INTRODUCTION

Zambia is one of the most forested countries in Africa, with about 50 million out of the 75 million hectares (ha) total land area, under some form of forest cover (Government of the Republic of Zambia 2014; Kalinda et al. 2013; GRZ and FAO 2009). However, the country also has one of the highest rates of deforestation and degradation in the world, estimated at 250,000-300,000 ha of forest loss per annum (Vinya et al. 2011). Reversing/slowing this high deforestation and degradation trend will require the country to design and implement programs and strategies that will effectively deal with both the proximate and underlying drivers of deforestation and degradation. A precondition to designing such programs and strategies is a clear identification and understanding of the main drivers of deforestation, both proximate and underlying. Implementing such programs and strategies is important to help the country contribute to climate change mitigation efforts, and benefit from international climate mitigation initiatives such as the UN-REDD programme[3] *inter alia*.

A number of studies have been conducted in the recent past to identify the main drivers of deforestation and forest degradation in Zambia (e.g., Vinya et al. 2011; Chundama 2009; Chidumayo et al. 2002). In all these studies, wood fuel production and use is identified as one of the top proximate drivers of deforestation and degradation, second only to agricultural expansion. While the evidence is compelling that charcoal and firewood (collectively referred to as wood fuel in this study) is one of the major drivers of deforestation and degradation, there appears to be an under-appreciation of the role of customary land institutions in wood fuel production and/or marketing, and forest management in general. Customary land administration systems, in which forestry management systems are embedded, guide the daily management and consumption and/or use of land resources including forests. Further, land tenure directly determines who has the right to benefit from forests and who has duties to protect it (Robinson, Holland, and Naughton-Treves 2011). While it is important to identify and address the population drivers of wood fuel production and/or marketing, what is even more important is understanding the institutional arrangements, which provide user rules and rights, as well as enforcement and sanctions/penalties for rule-breakers. Thus, it is critical that local land and forest management institutions form an integral part of analyses concerning local forest management.

Most discussions and debates on reducing wood fuel production and/or marketing in rural areas assume that rural households usually engage in wood fuel production and/or marketing to supplement household income during or following seasons of poor agricultural production, and to respond to urban demand for charcoal (Mwitwa and Makano 2012; Chidumayo et al. 2002). A number of studies note that the supply side drivers of charcoal production are intertwined and mainly associated with rural household poverty and the need to supplement agricultural incomes. Hence, most interventions aimed at reducing charcoal production tend to focus on improving agricultural productivity and increasing income portfolios for smallholder rural households, while paying scanty attention to local land institutions, and how these affect local forestry management. With over two thirds of the country's total forest area on customary land and only about 24% under state land (Kalinda et al. 2013; GRZ and

[3] The United Nations Framework Convention on Climate Change (UNFCCC) developed the *"Reducing Emissions from Deforestation and Forest Degradation plus other interventions"* (REDD+) mechanism to provide financial incentives to reduce such emissions. REDD+ includes *"Reducing Emissions from Deforestation and Forest Degradation"* (initially referred to as REDD) as well as: i) conservation of indigenous forests; ii) sustainable management of forests; and iii) the enhancement of forest carbon stocks.

FAO 2009), traditional authorities have a significant role to play in reducing wood fuel production and deforestation and/or degradation in general. Therefore, understanding forestry management institutions under customary land administration systems can provide insights into how such systems can be leveraged to reduce deforestation and degradation from wood fuel production and/or marketing, and help promote sustainable local forest management.

Against this backdrop, this paper has three research objectives. First, we examine the socioeconomic factors that influence rural household participation in wood fuel[4] production and/or marketing. As discussed above, this is something that has been extensively explored in the extant literature with a focus on wood fuel production in Zambia. However, we empirically revisit this aspect because this is vital for understanding the link between customary land tenure institutions and local forestry management. Furthermore, existing studies are mostly descriptive and based on small samples, often from selected regions of the country. The current study builds on this by using nationally representative data and econometric methods to control for unobserved factors. Second, we explore what local forest management interventions have been designed and implemented by customary land administrators and their local communities. Third, we assess the effectiveness of local forest management institutions in curbing deforestation.

[4] In this study, wood fuel refers to both charcoal and firewood as in Zulu and Richardson (2013).

2. BACKGROUND AND CONCEPTUAL FRAMEWORK

2.1. Defining Forests, Deforestation/Forest Degradation

Forests are important for human existence, through their ecological functions, which include: regulating the climate and water resources, serving as habitats for flora and fauna, and providing products and services such as wood fuel, timber, fodder, medicines, recreation, and spiritual renewal (CBD 2002; FAO 2000; Hodgson and Dixon 1988). Thus, there is a common understanding of the importance of forests for human wellbeing. However, the definition of *forest* has been debated for a long time and hence several definitions exist.

FAO (2000) defines a forest as land with tree crown cover (or equivalent stocking level) of more than 10% and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters at maturity *in situ*. In addition, the land should not be predominantly under agricultural practices, but may consist either of closed or open forest formations, and excludes land that is under agriculture production.

The Convention on Biological Diversity group (CBD) defines a forest as land area of more than 0.5 ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land use. In the case of young forests or regions where tree growth is climatically suppressed, the trees should be capable of reaching a height of 5 m *in situ*, and of meeting the canopy cover requirement. The group considers the FAO definition of a forest as the basic one (FAO 2000), but acknowledge that many other useful definitions of forest exist in published form. The fact that forest has been defined in many ways is a reflection of the diversity of forests and forest ecosystems in the world and of the diversity of human approaches to forest resources (CBD 2002).

In all these definitions, what is most salient and similar is that the definition of forest is specific about the number of trees per given land area, and it excludes land that is under some form of agricultural production. The latter includes plantations of fruit trees with the main aim of producing fruit and other goods. In addition, gardens, agroforestry areas, and urban parks are not considered as forests. However, plantations of trees with the primary objective of producing wood and wood-related products are considered forests (FAO 2000). For international comparisons of forest cover change, the UNFCCC recommends that countries use the FAO definition.

2.1.1. Deforestation and Degradation

It is very common for *deforestation*, and *degradation* to be used interchangeably in most debates, and in studies in other fields. It is against this backdrop that we take time to distinguish the two terms and what they imply. This is very important as it will guide our discussions of the impact of charcoal production on forests in later sections of the paper. As deforestation and degradation are associated with forests, the definition of deforestation and degradation is as diverse as that of forest itself.

Definitions vary across countries, and within countries at the state, provincial, and local levels (CBD 2002). The most commonly used definitions are drawn from FAO (2000). The FAO defines deforestation as change of land cover with a resultant depletion of tree crown cover to less than 10%, while degradation is defined as changes within the forest which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products and/or services. These changes can either be natural or human-induced.

From the foregoing, it is clear that deforestation is associated with the long-term or permanent loss of forest cover and implies transformation of forests into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural disturbance. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs, and urban areas. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures (CDB 2002). Degradation on the other hand, takes different forms, particularly in open forest formations, mainly resulting from human-related activities such as over-grazing, over-exploitation (for firewood or timber), repeated fires, or due to attacks by insects, diseases, plant parasites, or other natural sources such as cyclones. In most cases, degradation does not show as a decrease in the area of woody vegetation but rather as a gradual reduction of biomass, changes in species composition, and soil degradation (*Ibid*).

Different definitions of forest can produce varying deforestation and degradation rates. Romijn et al. (2013) show that how a forest is defined can have a large impact on deforestation and forest degradation estimates, assessment of drivers of deforestation, and the development of a Reference Emission Level. They illustrate this with data from Indonesia. Using the FAO definition, the total deforested area was 4.9 million ha between 2000 and 2009. This estimate was 18% and 27% higher when using the natural forest and national definitions, respectively. It is evidently clear from this case that policy needs to be based on a forest definition that is relevant to a particular country and objective.

2.2. Charcoal Production and Deforestation/Degradation

Although charcoal is mainly associated with degradation, and less so with deforestation, there is growing evidence linking charcoal to deforestation. Charcoal production causes localized but increasing deforestation and environmental degradation, which ultimately undermine ecosystem functions (Clancy 2008). In Tanzania, a study by Malimbwi et al. (2005) report that charcoal production and crop cultivation had high impacts on large-scale deforestation that occurred in the Mbwewe, Bana, and Kitulangalo areas. Although cultivation has been a major source of woodland change and deforestation in southern Africa, its contribution in the study area was found to be negligible compared to charcoal production between 1991 and 1998. Of the 199,000 ha of closed woodlands in 1991, only 5% of closed woodlands, 9% of open woodlands, and 7% of bush lands had been converted to mixed cultivation and very little to annual cultivation. On the other hand, charcoal production was responsible for degradation of 25% of closed woodlands, deforestation of 20% of closed woodlands, and 51% of open woodland. The results indicate that charcoal production has been a major source of deforestation and woodland degradation in these areas, which was confirmed by 75% of the respondents in the study areas.

As charcoal producers prefer certain tree species, it was evident that tree species suitable for charcoal production had been depleted along the roadside and the average distance to charcoal production sites had increased. Open woodlands were the most affected with about 45% tree cover loss, while in the closed forest the tree cover loss was about 26%. A similar trend was observed in Chongwe District in Zambia, with woodland cover having decreased at

a rate of 3.2% annually, and the highest rate of change of 8.8% occurring in Munga woodland (Chidumayo 1998).[5]

A study by Vinya et al. (2011) on drivers of deforestation and potential for REDD+ in Zambia, finds that charcoal production is by far the most frequent driver of deforestation in nearly all of the seven provinces sampled for the study. The major factor driving up charcoal production is high energy demand in the country's urban centres. Fuelwood production is estimated to contribute at least 3% of the country's gross domestic product, and accounts for approximately 80% of the economy's total energy household balance (Kalinda et al. 2008). Such high demand for, and consumption of charcoal has implication on deforestation. Tembo, Mulenga, and Sitko 2015 estimates the annual consumption of charcoal by urban households in 2010 to be 198,217 tonnes. This quantity of charcoal is produced from 1.187 million tonnes of cordwood, which is equivalent to 23,268 ha of well-stocked plateau *miombo*. According to Kambewa et al. (2007) the urban energy consumption study in Malawi estimated that the total volume of charcoal consumed in the four largest urban areas of Malawi is about 6.08 million tonnes, translating into more than 1.4 million cubic metres of wood annually. This is the equivalent to clearing slightly over 15,000 ha of woodland annually, contributing about one-third of the annual deforestation in Malawi.

Another pathway through which charcoal contributes to deforestation is the conversion of a charcoal production area into agricultural land. With increasing population and demand for agricultural land, charcoal production areas are increasingly being converted to agricultural land. A study by Malimbwi et al. (2005) aimed at estimating the contribution of charcoal extraction to deforestation in Tanzania showed that about 15% of the land that was previously used for charcoal production was turned into farmland, resulting in complete land use change and forest loss. The remaining 85% of the land used for charcoal production was not converted to farmland, and these areas experienced substantial regeneration. Therefore, land management practices that discourage further disturbance of previously cut down areas help such areas progressively revert to woodland (Chidumayo et al. 2002).

2.3. Forestry Policy and Regulations

In Zambia, there are two pieces of legislation concerned with addressing wood fuel production and consumption, and these are: 1) Revised National Forestry Policy of 2014 and 2) National Energy Policy. These pieces of legislation provide guidance concerning wood fuel production and consumption. The forestry policy and regulations provide guidelines on the extraction and use of forestry products, while the energy policy has as one of its objective to reduce consumption and reliance on wood fuel, and promote cleaner, and cheaper alternative energy sources. Thus, in order to reduce deforestation driven by increasing wood fuel demand, it is critical that effective synergies are promoted between forest and energy policies in Zambia (Vinya et al. 2011).

In terms of forestry management, the Revised National Forestry Policy of 2014 encourages participatory forest management based on the active participation of local communities, traditional institutions, private sector and other stakeholders in the management and utilization of forest resources at all levels of decision making, implementation, monitoring

[5] Acacia trees dominate Munga woodlands and are common to the Zambezi and Luangwa river valleys of Zambia (Mickels-Kokwe 2006).

and evaluation. The policy emphasizes and recognizes the important role of devolving forestry management and utilization to local communities, and other stakeholders. These were also highlighted and encouraged in the Forestry Policy of 1998. However, there has been very little progress towards achieving these objectives, mainly because of lack of implementation.

From a historical perspective, from the 1960s to early 1980s, two main pieces of legislation guided the management and utilization of forest and forest products. These were: the Forest Act No. 39, and Forest Policy of 1973, and Regulations of 1976. The Forest Act, supported by Forest Regulations, is the law governing the management of the forest estate in Zambia, especially the indigenous forests which are easy to exploit. These pieces of legislation provided guidelines in all areas of forestry in the country and included establishment and management of plantation forests, forest products research, and research in indigenous and exotic forests. Prior to the 1998 policy, the previous forest policy provided guidelines in all areas of forestry in the country and included establishment and management of plantation forests, forest products research, and research in indigenous and exotic forests.

The forest management model in Zambia is based on the Forest Act of 1973 (GRZ 1973), Forest Regulations (1976) and the Forest Policy of 1998. The forestry sector has maintained a central approach to forest management that is largely exclusive of local community involvement. In order to be consistent with the current overall Government policy of promoting private sector and community participation in forestry sector development, a new forestry policy was formulated in 1998. The overarching strategy of this policy was the establishment of Joint Forest Management (JFM). The JFM arrangement entails the sharing of Forest management responsibility and revenues between the state and the community and are formalized through a joint forest management agreement. Following this strategy, the Forest Department proposed a Joint Forest Management model with the community and enacted the 1999 Forest Act to implement the JFM. The 1999 legislation has not been implemented and the principle legislation remains the Forest Act of 1973.

Owing to the fact that about two thirds of the forest is located on customary land, mobilizing local community participation in forest management is critical for any forest conservation strategy to be effective. However, the delay in implementing JFM initiatives beyond just pilot projects has inhibited the local communities' participation in the management of the forest estate. While the Forest Act of 1973 places the Forestry Department as the sole forest estate manager with "a central policing role", the 1999 Act (which is not in effect due to delays in ratification) provides for the participation of local communities in terms of conservation and obtaining benefits accruing from forests. In addition, the latter provides for the establishment of the forestry commission, a new quasi-government organization that was supposed to take full responsibility for the management of forest resources in Zambia (Mwitwa and Makano 2012).

2.4. Local Institutions and Forest Management

Despite a growing awareness among development practitioners, and researchers that the actions of local people greatly determine the success or failure of natural resource management, the bulk of analyses concerned with forest exploitation in developing countries lack linkages to the local level. Since most debates pertaining to causes of deforestation and other environmental problems have largely concentrated on macro analyses, there has been an under appreciation of evidence generated from micro-level data which provide rich

information on the social and economic factors that mediate the relation between population and the environment (Arizpe, Stone, and Mayor 1994). It is therefore important to better understand the relationship between forest conditions, individuals, and institutions at a local level. Local institutions, such as land and forest management can modify the effect of factors thought to be the drivers of deforestation. Therefore, institutions can either amplify or attenuate the incentives for engaging in activities that contribute to deforestation. (Ostrom 1998).

In Zambia land administration is largely guided by The Lands Act of 1995 and the national Constitution (1996). All land in Zambia is vested in the Republican President, held on behalf of the Zambian people (GRZ 1995). The Lands Act of 1995 and the national Constitution (1996) recognise two types of land tenure systems, which are customary land and state land. Land under customary tenure is further subdivided into Trust and Reserve land. Both the Reserve and Trust lands are administered on behalf of the local people by the traditional rulers under a customary law, while state land is administered by central Government through the Commissioner of lands in the Ministry of Lands, where title deeds may be offered to individuals, institutions and companies.

With respect to distribution of the two types of land, Kalinda et al. (2008) found that 61% of the land is under traditional authorities, with the headmen/headwomen being the front line custodians. The headmen/women are under the Chiefs, and the latter are custodians of the land on behalf of the people. Chiefs make decisions on land-use and allocation, but the state maintains *de jure* ownership. The majority of forest resources (31 million ha or 63%) are found on customary land, with only 12 million ha located on state land (24%), and about 5 million ha on leasehold land (GRZ and FAO 2010). From the foregoing, it is evidently clear that customary land administration, and the management of forests located on this type of land are critical if Zambia is to succeed in its efforts to sustainably manage the forest resource.

Lack of adequate forest management strategies under customary tenure has been cited as one of the main contributors to deforestation resulting from charcoal production. Chidumayo et al. (2002) report that the potential of miombo woodland to regenerate and be used again for charcoal production in the future is thwarted by inadequate forest management in areas cleared for charcoal production on customary land and absence of areas dedicated to charcoal production. Furthermore, Angelsen and Kaimowitz (1999) note that in the absence of well-defined and secure property rights (a common feature in customary land tenure system), forest clearing often becomes a way to claim property rights to land (homesteading or *clear to claim*), in rural communities of developing countries. This is also reported by Dokken et al. (2014) in Tanzania, where they find that villagers in communities where land tenure is not secure opt to work the land for fear that government would take it away from them if it is not cleared. A review of over 100 empirical cases of forest outcomes under specific land tenure conditions by (Robinson, Holland, and Naughton-Treves 2011) suggests that deforestation and degradation are tied to a complex array of socioeconomic and political factors, and among the most important of these factors is land tenure and land tenure security. The review further shows that state-owned protected forests are associated with more positive forest outcomes relative to private, communal, and public land. Therefore, customary land tenure systems need to strengthen tenure security, and incorporate certain salient rules and plans found in state-owned protected forests in their land and forestry management systems. However, such rules need to be socially, culturally, and politically acceptable.

However, existence of rules and secure tenure is a necessary but not sufficient condition for sustainable forestry management. A study by Dokken et al. (2014) of REDD+ communities in Tanzania, reveals that some communities that were experiencing deforestation/ degradation cited lack of compliance with the forest user-rules as one of the underlying drivers of deforestation. Driving forces related to reduction in forest quality were lack of rules and rule enforcement in four of the seven villages, while increased profitability from charcoal production were the driving force in the remaining three villages. However, some communities reported an increase in forested area, and these cited conservation education, and strong rules as a driver for the increase in the forested area. Hence, even when rules are in place it is important to also put in place mechanisms to deal with internal factors that may have adverse effects on collective action in managing forests.

Given that more than two-thirds of all forests in Zambia are located in customary land and are not formally managed, there is need to increase the proportion of forests that are formally managed, both through decentralization and provision of forest extension services. According to GRZ and FAO (2009), only 23% of forests are formally managed with elaborate forest management plans in place. About 41% are traditionally managed but have no formal management plans in place and another 36% of forests are not known, and are assumed not to be under any form of management. Furthermore, most of the forest on customary land are managed based on limited knowledge and management capabilities. Therefore, there is need to expand forestry extension services beyond forest reserves to include even traditionally managed forests so that traditional authorities incorporate scientific information in forest management and ensure that utilization patterns are sustainable (Kalinda et al. 2013). In addition, there is a need to bring more forests under formal management and more importantly, devolve and share some forest rights and responsibilities over public forests with local communities, user-groups, and the private sector (*ibid*). The devolution of rights and responsibility to local communities and private sector is one of the focus of the 1998 National Forestry Policy, which envisions implementation of JFM as one way of devolving forestry management. However, the initiative has been hindered by failure to enact the 1999 Forestry Act, which is intended to facilitate the establishment of JFM.

2.5. Drivers of Deforestation and Degradation

Drivers of deforestation/degradation can be categorized into two broad groups, i.e., proximate, and underlying drivers. It is important, before proceeding with discussion of these drivers, to distinguish between these two types of drivers. According to CBD (2002) the underlying (or ultimate) causes of deforestation/degradation are the factors that motivate humans to degrade or destroy forests; these tend to occur through a series of complex causal chains. The underlying causes often originate in some of the most basic social, economic, political, cultural, and historical features of society. These can be at various levels from local, national, and regional, to global, transmitting their effects through economic or political actions such as trade or incentive measures (WWF 1998). The direct (or proximate) causes of forests loss or destruction are human induced actions that directly destroy the forests such as uncontrolled charcoal burning, conversion of forest land, continuous overexploitation and large scale logging, or compromise their quality by, for instance, unsustainable forest management and pollution

2.5.1. Underlying Causes

A good example of underlying cause of deforestation/degradation is the land tenure system that is oblivious to forest management. Land tenure systems that do not have effective measures of conserving forests risk promoting livelihoods that are detrimental to forests, such as uncontrolled agricultural land expansion, charcoal burning, indiscriminate cutting down of trees for firewood, and human induced forest fires. Land tenure insecurity and lack of recognition of the rights and needs of forest-dependent communities have also been identified as major underlying causes of deforestation/degradation (United Nations Economic and Social Council 2000). Although poverty is in most cases considered an underlying cause of forest destruction, evidence shows that it is both a consequence and an underlying cause of forest decline. Poverty often leads to deforestation and forest degradation. The poor are often compelled to engage in unsustainable agricultural practices or degrade forests in response to population growth, economic woes, and environmental degradation (CBD 2002).

However, the linkages between rural poverty and forest destruction are complex and poverty does not necessarily lead to forest decline. Many poor people are able to adopt protective mechanisms through collective action which reduces the impacts of demographic, economic and environmental changes (CBD 2002). Angelsen and Kaimowitz (1999) contend that there is little empirical evidence on the link between deforestation and poverty. They argue that if forest clearing requires investment in clearing technology, then the wealthy may in fact be in a better position to clear new forest land. Moreover, off-farm employment opportunities simultaneously affect both poverty and deforestation, and any apparent relation between poverty and deforestation may actually be reflecting the off-farm employment-deforestation connection. A similar argument is reflected in Mulenga et al. (2014) who find that wealthier households in rural Zambia harvested larger quantities of forest products than the poor owing to the former's ability to invest in forest products' extraction technology

Also, energy policies that do not effectively promote use of clean energy sources (for example lack of strategies to improve access to electricity) coupled with population growth can result in destruction of forests. In Zambia, wood energy consumption has been rising due to factors such as population growth and the expansion of industrial activities, with a resultant increase in deforestation rate. Population pressures may increase incidences of deforestation/degradation, mainly due to rising demand for land for food production, fuelwood, timber, or other forest products (Angelsen and Kaimowitz 1999).
Other underlying drivers identified in Zambia include rising electricity tariffs, unreliable electricity supply, high price of electric cooking stoves, lack of reliable and affordable alternative energy sources (Tembo, Mulenga, and Sitko 2015; Mwitwa and Makano 2012; Malimbwi et al. 2005; Chidumayo et al. 2002). The high dependence on charcoal by urban households is also reported by Malimbwi et al. (2005) in Tanzania. It is assumed that 95% of urban household on Tanzania's mainland are dependent solely on charcoal and firewood. From the foregoing, it is inevitable that degradation of forests and woodlands on Tanzania mainland is somewhat, related to increasing demand for wood-energy particularly charcoal. This is because charcoal is reliable and majority can afford it.

Further, Mwitwa and Makano (2012) based on household survey and qualitative data, identify government's heavy involvement in the agricultural sector as one of the major underlying causes of rural households' engagement in charcoal production and marketing in Zambia. The study notes that the heavy involvement of government in the distribution of inputs and output marketing has created inefficiencies in the maize value chain resulting in late delivery/supply of inputs, consequently affecting agricultural productivity. Also, the

delayed payment of farmers who supply maize to the government's Food Reserve Agency (FRA) forces farmers to consider charcoal as an alternative and quicker source of cash income to meet their immediate cash needs.

The specific underlying drivers of deforestation are high poverty levels, low employment opportunities, brick-making, tobacco curing, insecure tenure rights, low institutional capacity (poor funding, low staffing levels, lack of reliable transport for monitoring) and lack of synergy among the various policies and acts of legislation.

2.5.2. Proximate Causes

CBD (2002) identifies some of the prominent proximate drivers of deforestation/degradation, and biodiversity loss, these include: agricultural development, unsustainable agricultural practices such as slash and burn, infrastructural development (dams, mining, roads), forest fires, global climate change, and pollution of water and soils. Angelsen and Kaimowitz (1999) present a comprehensive discussion of the immediate causes of deforestation. Among the identified causes are: agricultural output prices; wage income and off-farm employment opportunities; technological progress in agriculture; and land property rights. They argue that higher agricultural output prices motivate farming households to clear more land for agriculture. Further, higher agricultural output prices may increase capital required to bring more land under agriculture, hence clearing more forests. However, other studies (such as Mwitwa and Makano 2012; Mweemba and Hongjuan 2008), have reported the opposite. They argue that making agriculture more profitable reduces deforestation, as farming households are able to earn higher incomes from a given cultivated land area.

With regards to wage income and off-farm employment, Angelsen and Kaimowitz (1999) argue that higher off-farm wages are likely to shift labor away from agriculture and forest related activities, thereby reducing deforestation. Hence strategies promoting higher rural wages can help reduce deforestation and degradation. In terms of technological progress, promotion of technologies that make more intensive production systems more profitable reduce the need for clearing additional forest land for agriculture, as they increase yields (Holden 1993). A similar argument is made by Mwitwa and Makano (2012) and and Hongjuan 2008), where they recommend interventions aimed at improving agricultural productivity as a way to reduce rural households' participation in charcoal production and marketing. Vinya et al. (2011) identifies the major proximate drivers of deforestation in Zambia as shifting agriculture, agricultural extensification, charcoal production, fuelwood collection, logging, settlements, uncontrolled fires, industrialization, and urban expansion.

A number of deforestation/forest degradation drivers have been identified, with the most prominent being wood fuel demand and consumption, declining agricultural productivity, and inappropriate land and forest management systems.

2.6. Conceptual Framework

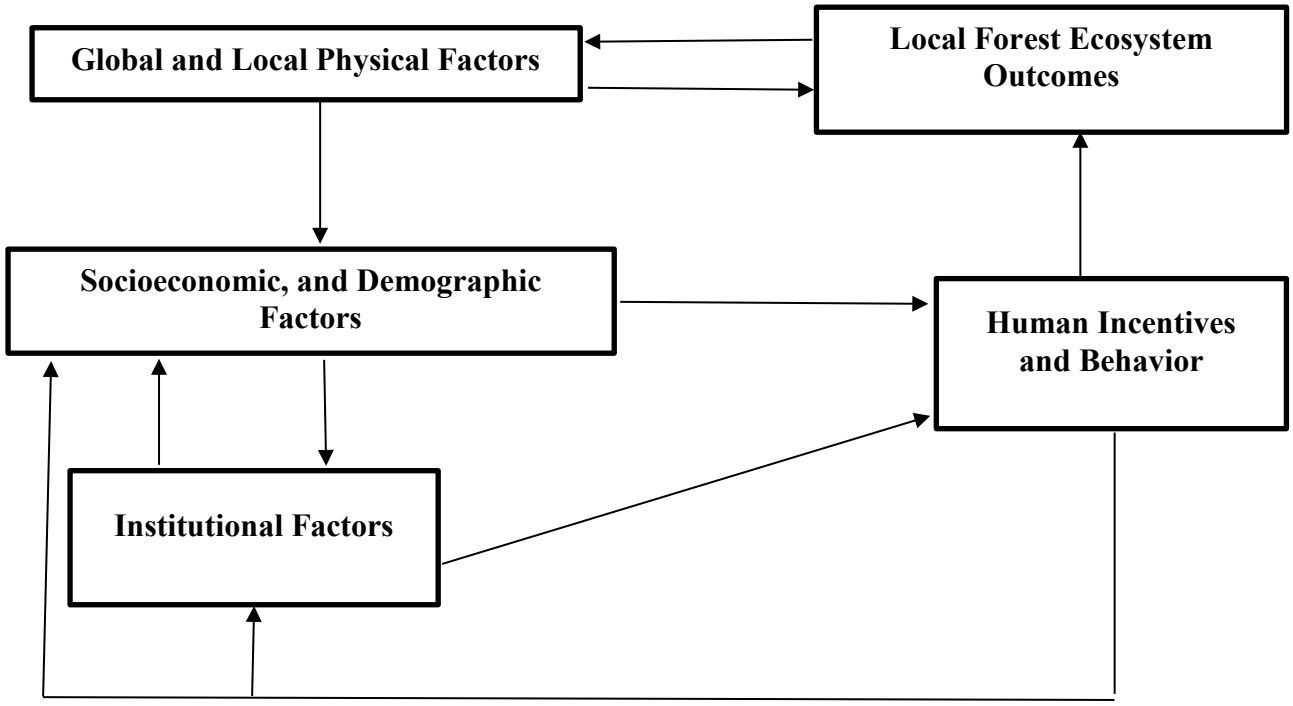
In order to help explain the expected linkages between household behavior, local institutions, and forest outcomes, we draw on the Institutional Analysis and Development (IAD) framework used over several decades to study how institutions affect human incentives and behavior as these impact on governance and management of natural resource systems such as forests in this study.

The IAD framework comprises individuals who hold different positions (e.g., members of a local forest user group, forest officials, landowners, elected local, regional, and/or national officials) who must decide upon actions (e.g., what to plant, protect, harvest, monitor, or sanction) that cumulatively affect outcomes in the forest conditions, the distribution of a forest's benefits and costs. To simplify representation, the complex set of incentives and resulting behavior is initially represented in Figure 1 as a single box.

From the IAD framework presented in Figure 1, human incentives and behavior impact on local ecologies (forests in this case) that are also affected by, and affect, global and local physical factors. Further human incentives and behavior are affected by socioeconomic and demographic and institutional factors. Each of the factors on the left-hand side of Figure 1 contains a large set of variables. For example, socioeconomic and demographic factors that may impact on human behavior and incentives, include, but not limited to: income levels, asset holdings, landholding size, kinship ties, off-farm employment and business opportunities, availability of labor to use in charcoal production and/or marketing, market access, education level, household size, etc. Institutional factors that may affect human incentives and behavior at a micro level include specific rules-in-use for certain land parcels.

With regards to forest products, institutions may include rules concerned with: 1) how much harvesting of different products is authorized or forbidden; 2) what types of afforestation or other enhancement or protection activities are encouraged and by what means; 3) the level of consensus among community members on what rules are used, monitored, and enforced; 4) whether forest users are organized and what such organization means in terms of individual incentives; and 5) what representatives of local, regional, or national government are involved in local activities.

Figure 1. The IAD Framework Relating Multiple Factors Affecting Local Forest Management



Source: Adapted from Ostrom 1998.

At a macro level, these would include, but not be limited to, such variables as: national legislation authorizing diverse types of forests and the restrictions in the use and administration of each type of forest, types of private and/or communal land tenure authorized, taxation laws on land, extraction rates, and corporate profits, and the availability of courts to resolve disputes over land and/or forest tenure. In this study, the focus is more on the micro level variables.

The socioeconomic, demographic, and institutional factors play a critical role in shaping the forest ecosystem outcome, largely through their impact on human behavior and incentives. Different types and levels of institutional arrangements interact with socioeconomic and demographic attributes in different ways resulting in particular outcomes of forest use and conditions. For example, land tenure and administration systems that fail to internalize the costs of forest resource depletion are more than likely to result in deforestation and/or degradation (Robinson, Holland, and Naughton-Treves 2011), especially where socioeconomic factors such as market access, and price of certain forest products, like charcoal are favourable. Local forests can also be impacted negatively by global factors, exogenous to the local communities, for example climate change. Conversely, the use and condition of local forests, which is largely shaped by the socioeconomic, demographic, and institutional factors, may impact on global biophysical state, through contribution to carbon emission resulting from deforestation and/or degradation. Further, global and local biophysical conditions may affect the socioeconomic and demographic factors of local communities. It is clear from the framework presented that at the core of forest outcome are local institutions and human behavior and incentives.

3. DATA AND METHODS

In this study, we use a mixed methods approach—quantitative and qualitative methods—to address the overarching question whether the customary land tenure system encourages or discourages local forestry management in Zambia. The data are drawn from nationally representative household survey data, and information from focus group discussions and key informant interviews.

3.1. Source of Quantitative Data

For quantitative analysis, the study uses the Rural Agricultural Livelihood Survey of 2012 (RALS12). Indaba Agricultural Policy Research Institute (IAPRI) conducted the Rural Agricultural Livelihood Survey (RALS) in collaboration with Central Statistical Office (CSO) and Ministry of Agricultural and Livestock (MAL) from June to July 2012. This survey covered the 2010/11 agricultural season, and the 2011/12 crop marketing year. RALS12 data sampled 8,839 smallholder households in all 10 provinces of Zambia and collected data on socioeconomic, demographic characteristics, production activities, and income sources. Further RALS also collected data on natural resources access and utilization, and input and output market access. On charcoal, RALS12 collected data on whether a household participated in charcoal/firewood production and/or marketing. The RALS12 dataset thus allows for econometric estimation of determinants of household participation in charcoal/firewood production and and/or marketing, as well as descriptive analysis to compare socioeconomic characteristics of households involved in charcoal/firewood production and/or marketing and their non-participating counterparts.

It is important to stress here that wood fuel households may have been under sampled because the RALS12 is an agricultural livelihoods survey whose sampling frame targeted agricultural households in rural Zambia. However, in practice, even if wood fuel producers may not be farmers, they usually have a small piece of land for food production for the home, and these were captured by RALS12. Thus, RALS12 dataset is appropriate for the analysis conducted in this study.

3.2. Sources of Qualitative Data

Qualitative data was obtained thorough Focus Group Discussions (FGDs) with local community members in seven communities from three districts. A total of 68 participants were involved in the focus group discussions in all seven communities, 38 of whom were male and 30 were female. The three districts visited are Mumbwa, Kapiri Mposhi, and Nyimba. The first two are from Central Province while the latter is in Eastern Province. These districts were, to a large extent, purposively selected, but also they are a good representation of the three types of charcoal producing areas we aimed to study, that is: 1) areas with a long history of charcoal production (Nyimba); 2) charcoal producing and transit areas (Kapiri Mposhi; and 3) new charcoal producing areas (Mumbwa). In-depth interviews were also conducted with traditional leaders (headmen) in four of the seven communities visited. Furthermore, key informant interviews were held with personnel from Forestry Department (personnel from national office), the Center for International Forestry Research (CIFOR) (personnel from national office), Community Youth Concern (a local non-governmental organization based in Nyimba District, working with local communities on sustainable natural resources management, among other issues), and Ministry of Agriculture and Livestock district personnel.

4. ANALYTICAL FRAMEWORK AND ESTIMATION STRATEGY

4.1. Econometric Analysis

In order to address the first objective of determining socioeconomic factors influencing household participation in charcoal/firewood production and/or marketing[6], a binary dependent variable model specification is the most appropriate. The model specification is such that the dependent variable (household participation in charcoal/firewood production and/or marketing takes on a value of one if a household participated and zero otherwise. Two standard binary response models that are typically used are logit model and probit model. Linear probability model (LPM) which is fitted by ordinary least squares is also used sometimes but it has two major drawbacks: (i) the fitted probabilities can be less than zero or greater than one, and (ii) the partial effect of any explanatory variable is constant (Wooldridge 2010). In standard binary outcome models, the conditional probability takes the form:

$$Pr(y_i = 1|X) = F(X_i'\beta) \qquad (1.0)$$

Where *Pr* is the probability of the binary outcome y, which is dependent on a set of exogenous explanatory variables $X_i\beta s$ are the unknown parameters to be estimated. The predicted probability falls between zero and one $(0 \leq Pr \leq 1)$ and $F(.)$ is a specified parametric function form for X_i, β. The two models (logit and probit) are similar except that they assume different functional forms. A logit model assumes a logistic distribution specified as $F(.) = \Lambda(.)$ while a probit model assumes a standard normal distribution specified as $F(.) = \Phi(.)$. Since both models are non-linear the estimated coefficients cannot be interpreted like linear models therefore partial effects are estimated. The two models are estimated using the maximum likelihood estimation given their non-linearity. For this study a probit model is used to determine the factors that influence whether a household participation in charcoal/firewood production and/or marketing. Therefore, the empirical apparatus used to quantitatively explore the drivers of wood fuel production and marketing is given by the following equation:

$$Y_i = \alpha_i + \boldsymbol{X_i}\beta + \varepsilon_i \qquad (2.0)$$

where α_i is the constant term, ε_i is the error term capturing the unobserved heterogeneity and all other variables are as defined above. Due to data limitations, our econometric analysis does not include institutional variables; as such institutional analysis is based on qualitative data.

4.2. Qualitative Assessment

To deepen our understanding, we also conduct a comparative assessment of stakeholder views drawn from FGDs and in-depth interviews from the three case study districts. Transcripts and expanded notes were reviewed multiple times to identify key themes and concepts to explore: (1) the socioeconomic factors that influence rural household participation in wood fuel production and/or marketing; (2) what local forest management interventions have been designed by customary land administrators and their local communities; and (3) the effectiveness of local forest management institutions in curbing deforestation.

[6] In this study we refer to wood fuel production and/or marketing as wood fuel business, and its participants as *participants*. Those that did not participate are referred to as *non-participants*.

5. RESULTS AND DISCUSSION

5.1. Descriptive Results

This section presents descriptive statistics and discussion based on the RALS12 dataset. Table 1 shows a summary of the sample characteristics, and goes a step further to compare these characteristics between wood fuel business participants and non-participants. With regards to demographics, there is a statistically significant higher proportion of younger heads among the wood fuel business participants than the non-participants. In addition, proportionately more participant households are headed by male heads than non-participants. It appears therefore, that households headed by younger heads, mostly male, dominate the wood fuel business. In terms of wealth, no statistically significant differences were observed across the two groups. As for agricultural productivity and participation in agricultural output markets, there was a significant difference in percentage of households across the two groups, with the non-participants having significantly higher maize yields, and more households growing cash crops, than participants. In terms of extent of output market participation, non-participants participated more in agricultural output markets than participants, as indicated by the household commercialization index (HCI), which is significantly higher for non-participants (0.34) versus 0.26 for participants. This is somewhat indicative that participants in wood fuel business are less involved in agricultural production and marketing. The significantly lower share of agricultural income for participants further buttresses the point that participant households are less engaged in agriculture than their non-participant counterparts. An analysis of the contribution of different major income sources to household income indicates participant households having significantly higher income share from formal and informal businesses (47%) compared with 17% for non-participants.

However, non-participants had significantly higher income share (7%) from non-agricultural sources (which is mostly made up of non-agricultural wage income) than participants whose income share from this source only accounted for 2%.

Generally, the pattern shows that participants are more engaged in non-agricultural enterprises, and this could be an indication that wood fuel business is not a part-time activity for these households but rather forms an integral part of their livelihood strategies. Turning to land ownership and access, it is interesting to note that participants own significantly less land (2.7 ha on average) compared to the 3.4 ha, on average, owned by non-participants, further underscoring the former's low engagement in agriculture. However, it is also interesting to note that a significantly higher percentage (13%) of participants had land titles compared to 10% among the non-participants. Furthermore, results from descriptive analysis show that on average, proportionately more wood fuel household heads were related to a chief. This, most likely, is an indication that participants are well connected socially, as the process of land titling is overly long and administratively costly. Therefore only well connected and capitalized rural households would navigate through the process of land titling.

In order to get a more focused comparison of socioeconomic characteristics between wood fuel participants and non-participants, we focus the analysis on districts where household participation in wood fuel-related activities is greatest. To do this we define a sub-sample of households in districts where at least 10% of the interviewed households reported participation in wood fuel production and/or marketing (Table 2).

Table 1. Socioeconomic Characteristics of Wood Fuel Participants and Non-Participants

Attribute	Overall	Non-Wood fuel HHs	Wood Fuel HHs	t-test
Demographics of head				
Age of the head	45.49	45.63	43.04	***
Sex of the head (1=male)	0.81	0.8	0.88	***
Education of the head	6.17	6.19	5.97	
Wealth				
Value of assets owned (ZMW)	15859	16507	5013	
Total Household income ZMW (median)[1]	7574	7516	8544	
% hh below poverty line[2]	81	81	83	
Crop production				
% hhs grew cash crops	27	28	20	***
Gross value of all crops per Ha (ZMW)	2808	2807	2822	
Maize yield	2285.62	2295.96	2100.25	**
Kinship ties (%)				
Migrant household head (=1)	11	11	10	
Local hh head (=1)	88	88	12	
Head related to headman (=1)	63	63	68	
Head related to chief (=1)	27	26	41	***
% share of income sources				
Crop income share	65	66	45	***
Livestock income share	6	6	3	
Agriculture wage/salary income share	1	1	1	
Non-agriculture income share	6	7	2	***
Business income share	19	17	47	***
Remittances	2	2	1	***
Land ownership and acquisition				
Landholding size (Ha)	3.78	3.84	2.77	***
% hh with titled land	11	10	13	*
Market participation				
% hh with loan access	16	16	11	***
% hh hired in labor	28	28	24	*
% hh purchased commercial fertilizer	27	27	25	
% of households acquired FISP[3]	38	39	27	***
HCI	0.34	0.34	0.26	***
No. of households	1,417,992	1,334,345	83,647	
Population share		94.1%	5.9%	

Source: Authors' computations from RALS12; Note: [1] Nominal income, [2] We use the poverty line of USD1.25 per day, [3] Acquired fertilizer from the Farmer Input Support Program.

Table 2. Socioeconomic Characteristics of Wood Fuel Participants and Non-Participants in Districts Where Wood Fuel Production Is Greatest

Attribute	Overall	Non Wood fuel HHs	Wood fuel HHs	t-test
Demographics				
Age of the head	45.64	46	43.51	**
Sex of the head	0.82	0.81	0.87	**
Education level of the head	6.52	6.56	6.25	
Wealth				
Value of assets owned	8767	9658	3513	*
Total household income (ZMW)	8059	7938	8460	
% below poverty line	0.8	0.79	0.82	
Crop production				
% grow cash crop	0.11	0.1	0.12	
Gross value of all crops per ha	3039	3060	2919	
Maize yield (kg)	2216.83	2228.06	2147.43	
Kinship ties				
Head related with chief/headman	25	25	29	
Head is not local to the area	0.11	0.11	0.1	
% income share				
Business income share	26	22	52	***
Crop income share	56	59	42	***
Livestock income share	5	5	2	***
Non Agric. wage share	8	9	2	***
Remittance share	2	3	1	***
Land ownership and acquisition				
Landholding size	3.33	3.48	2.45	**
% with titled land	17	17	18	
Market participation				
% hhs access loan	5	5	5	
% hhs hired in labor	32	32	29	
% purchased commercial fertilizer	26	26	26	
% acquired from FISP	29	30	23	**
HCI	27	28	24	*
% households		86%	14%	

Source: Authors' computation from RALS12.

At that time in Zambia, of the 72 districts, only 20 districts had at least 10% of sampled households obtaining income from production and/or marketing of wood fuel. In these 20 districts, wood fuel participants accounted for 14% of the total households interviewed. Generally, the picture is similar to the national level, with participants being relatively younger males with less education. In terms of asset ownership, participants owned less valuable assets than their non-participating counterparts. A similar picture emerges in terms of landholding size, with participants owning less (2.45 ha) land than non-participants who owned 3.48, on average.

Having established the socioeconomic characteristics of rural smallholder households participating in wood fuel business, next we examine the distribution of these households by province[7] in terms of wood fuel production and/or marketing prevalence. This analysis helps shed some light on differences in terms of prevalence of wood fuel production and marketing across provinces, as well as identifying areas (provinces in this case) where wood fuel production and/or marketing is mostly prevalent. Such analysis provides a basis for design of targeted forest conservation interventions. Table 3 presents results of the analysis of distribution of smallholder households that participated in wood fuel business in Zambia by province. The results were weighted using the sampling weights from the RALS12 based on the 2010 census of population and housing. From a weighted national population of over 1.4 million smallholder farming households, an estimated 83,647, representing 6% of the smallholder population participated in wood fuel business activities. Variations in number of households deriving income from this source were observed across all the 10 provinces.

Of all 10 provinces, Copperbelt had the highest percentage of households estimated to have participated in the wood fuel business, accounting for 16%. This is followed by Luapula Province, which had an estimated 12%. Following Luapula is Central Province where wood fuel participants accounted for 8% of the total smallholder population in the province. Lusaka is in fourth place, with 7% of participants. The remaining provinces had 5% or less of households involved in wood fuel production and/or marketing, with the lowest being Eastern, Muchinga, and Southern each with 3% of wood fuel participants. It is however surprising that Eastern Province has a low percentage of wood fuel participants, considering the high volumes of charcoal transported from the province into Lusaka District. Focus group discussions and key informant interviews revealed that most charcoal producers are not willing to be identified as the activity is widely seen as illegal.

Table 3. Distribution of Smallholder Households Participating in Wood Fuel by Province

Province/national	Weighted Population	No. (%) of Wood fuel hhs
Central	159,774	13,053 (8%)
Copperbelt	78,926	12,882 (16%)
Eastern	265,418	7,680 (3%)
Luapula	150,303	18,922 (12%)
Lusaka	43,320	2,966 (7%)
Muchinga	116,476	3,775 (3%)
Northern	172,408	7,071 (4%)
Northwestern	100,295	4,327 (4%)
Southern	186,131	6,117 (3%)
Western	144,941	6,853 (5%)
Zambia	**1,417,992**	**83,647 (6%)**

Source: Authors' computations from RALS12.

[7]With the exception of Eastern Province, where the data is representative at both district and province levels, the remainder of the data is representative at province level. Thus we use province as a unit of analysis to assess prevalence levels.

5.2. Drivers of Deforestation/Degradation and Factors Affecting Household Participation in Wood Fuel Production

This section comprises two parts: the first part uses information elicited from FGD participants on drivers of deforestation/forest degradation, and factors influencing household participation in wood fuel business; the second part uses econometric modelling approach to estimate determinants of household participation in wood fuel business.

During focus group discussions, community members in all seven sites were asked to identify the major drivers of deforestation and degradation in their communities in order of their significance. This was meant to help in assessing the extent to which wood fuel production and /or marketing contributes to deforestation/degradation. In all the seven sites, agricultural land expansion was ranked first, followed by wood fuel production (Table 4).

However, discussants strongly felt that charcoal is implicitly the leading driver of deforestation/degradation since most households that clear forest to expand their agricultural land, use the trees to produce charcoal. In all the three sites in Nyimba District, discussants indicated that there was an increasing trend among community members to clear forests under the pretext of expanding their fields, when in fact the main intention is to produce charcoal. When asked to what extent the forest resources are used for wood fuel production as an income source, discussants in all seven sites explained that there was an increasing number of households producing and marketing wood fuel in their communities. It was clear from the discussions that forest resources were being used, to a large extent, for wood fuel production.

Table 4. Community and Household Level Drivers of Deforestation and Wood Fuel Production

District	Village/ community	Major drivers of deforestation/degradation	Major factors influencing household participation in wood fuel production
Mumbwa	Tumbama	Agricultural land expansion; wood fuel	Poverty; unemployment
	Kabwanga	Agricultural land expansion; wood fuel	Poverty; unemployment
Kapiri Mposhi	Ndili	Agricultural land expansion; wood fuel	Poverty; unemployment; lack of agricultural output markets
	Green leaf	Agricultural land expansion; wood fuel	Poverty; unemployment;
Nyimba	Pondani	Agricultural land expansion; wood fuel	Poverty; unemployment; poor weather for crops
	Lwembe	Agricultural land expansion; wood fuel	Poverty; unemployment; poor weather for crops
	Zubalinyenga	Agricultural land expansion; wood fuel	Poverty; unemployment

Source: Authors' summary.

Having established that wood fuel is one of the major drivers of deforestation/degradation, we asked community members to explain the factors influencing households' participation in wood fuel production and/or marketing. A number of factors were identified, but the major ones were: 1) poverty; 2) youth unemployment; and 3) lack of alternative means of livelihood (which is also closely linked to lack of employment). We discuss these in greater detail together with results from the econometric model in the section to follow.

5.2.1. Determinants of Household Participation in Wood Fuel Production and/or Marketing

In this section, we focus on understanding some of the major socioeconomic factors affecting household participation in wood fuel business, using the probit model. Table 5 presents probit estimates of the determinants of household participation in wood fuel production and/or marketing. The second column in the table presents the average partial effect (APE) of each independent variable on a household's probability of participating in wood fuel production and/or marketing, holding all other factors constant. Results show that age of the household head is a significant determinant of both the probability of participation. The negative sign of age of the household head suggests that households with relatively older heads are less likely to participate in wood fuel business.

Table 5. Determinants of Household Participation in Wood Fuel Production and/or Marketing

Variables	Average Partial Effect
Sex of head (male=1)	0.025***
	(0.006)
Age of head (years)	-0.001***
	(0.000)
Highest level of education completed by head	-0.002**
	(0.001)
Kinship ties (=1 if head related with chief/headman)	0.009
	(0.010)
Value of assets owned (ZMW)	-0.08***
	(0.001)
Log gross household income (ZMW)	0.361***
	(0.077)
Squared log gross household income (ZMW)	-0.011***
	(0.002)
Landholding size (ha)	-0.001*
	(0.001)
Log of maize yield (kg/ha)	-0.006*
	(0.003)
Household Commercialization Index	-0.049***
	(0.012)
Distance to nearest district centre (Km)	-0.004***
	(0.001)
Joint test for provincial dummy	143.91***
Observations	7,628

Standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1.

In order to capture the relationship between household life cycle and participation in wood fuel business, we tested for the significance of the square of age of the head in the model, but the quadratic term was not significant. The positive and significant coefficient of sex of the household head indicates that male-headed households are more likely to participate in wood fuel business than their female-headed counterparts. This result is in agreement with most literature (e.g., Mulenga et al. 2014; Shackleton and Shackleton 2006; Chidumayo et al. 2002). This was further confirmed by results from FGDs, where it came out clear from the discussions in all the seven sites that charcoal production is a predominantly male activity, with the youth becoming increasingly more involved. This also confirms the widely held assertion that wood fuel production and /or marketing is a predominantly male activity.

A negative and significant relationship exists between education and the probability of participation in wood fuel business. Households with heads with higher levels of education are less likely to participate in wood fuel business, mainly because education is associated with a wider range of income-generating opportunities. Education expands the possibilities for labor and employment, whereas household heads with low levels of education may be more economically vulnerable, thus, more likely to rely on income from wood fuel (Mulenga et al. 2014). However, the lack of employment opportunities in rural areas is increasingly compelling more youth, even the educated, to engage in wood fuel business. This was one of the most recurring themes during FGDs in all the seven sites.

The bulk of studies on drivers of household participation in wood fuel production and/or marketing point to poverty (or lack of wealth) as one of the major factors driving households into wood fuel business (e.g., Mwitwa and Makano 2012; Kambewa et al. 2007) In the above model we have three wealth indicators, namely: 1) gross household income; 2) value of assets owned; and 3) landholding size. Our model results are, to a large extent, in agreement with literature, as they indicate declining likelihood of participation with an improvement in household wealth. With regards to assets owned results show that increasing the value of assets owned by a household by one Zambian kwacha, reduces the probability of household participation in wood fuel by 8 percentage points.

Furthermore, results show that increasing household landholding size by one hectare reduces the probability of participation by 0.1 percentage points. In terms of gross household income, results indicate that initially an increase in household income increases the probability of participation, but the probability reduces with a further increase in income, as indicated by the negative and significant quadratic term of gross household income. This implies that an average participant in our sample would engage in wood fuel business to increase household income, but only up to a certain point, before the likelihood of participation declines. The foregoing implies a positive relationship between poverty and likelihood of participation in wood fuel business, and this supports the findings from FGDs as well as descriptive statistics, where it was evident that the poor were more likely to participate in wood fuel business than the well-off households. During FGDs, respondents explained that due to poverty they were unable to afford most of the agricultural inputs such as fertilizer, and seed. Hence they turned to wood fuel production and/or marketing as it presents one of the quickest alternative of raising cash to purchase agricultural inputs. Further, respondents indicated that other than agricultural inputs, the money realized from wood fuel business is used to pay for their childrens' school fees, books, and uniforms. The proceeds are also used to meet medical bills, and costs of other basic necessities.

In terms of agricultural productivity, particularly focussing on maize, the negative and significant APE on maize yield indicates that a unit increase in maize yield reduces the likelihood of participation in wood fuel by 0.6 percentage points. Results, therefore, imply that low agricultural productivity is among the important factors explaining participation, besides poverty. Furthermore, extent of participation in agricultural output markets (represented by HCI) significantly reduces the likelihood of participation in wood fuel. Also, the distance to the nearest district center, a proxy for market access, significantly reduces the likelihood of participation. Thus, households that have better access to markets for wood fuel are more likely to participate in wood fuel production and/or marketing as a source of income. This phenomenon is well documented in Zulu and Richardson (2013), where they note the important role of charcoal as an income source among rural households that have access to markets. The issue of market access was also highlighted during FGDs where respondents were quick to stress that being closer to district centers or main roadside makes wood fuel marketing easier, as it reduces on transportation costs and/ or level of effort for those using bicycles as a means of transport.

5.3. Local Forestry Management Institutions

In the last two sections, the study has established the following: 1) the characteristics of wood fuel participants; 2) local perceptions about drivers of local deforestation and forest degradation; and 3) determinants of household participation in wood fuel. In the current section we focus on local institutional arrangements. The aim was to identify existing local forestry management institutions and how effective these institutions are in curbing deforestation and/or degradation resulting from identified community and household drivers. Table 6 provides a summary of the major finding from the focus group discussions, in-depth interviews, and key informant interviews on the theme of local forestry management institutions and their effectiveness. From the focus group discussions, it was evident that rules exist at local level. However, these rules are informal without any documentation or laid down sanctions/penalties for rule-breakers. In addition, these rules are almost not enforced mainly due to lack of enforcement structures. With these features, the existing institutions are unable to internalize the costs associated with deforestation and/or forest degradation. Although FGDs were only held in three districts, key informant interviews with stakeholders revealed that the lack of formal local forestry management institutions is a national phenomenon.

A review of literature by Robinson, Holland, and Naughton-Treves (2011) on the relationship between land tenure system and forest outcomes in Africa shows that in most of Africa, customary rights are more common and had much historical significance. However, enforcement of traditional rules and regulations has, overtime, become increasingly difficult due to factors such as population growth, poverty, emerging market, and political forces Mwavu and Witkowski (2008). With such structural changes, what is needed to ensure compliance with the rules is to formalize the rules and strengthen enforcement structures at the local level.

In terms of existing rules, there was very little variation across all the seven sites. The main rules as described by FGD participants are: 1) no cutting down trees near stream/rivers, mountains, graveyards, and settlement areas; and 2) when opening land for agricultural production, tree cutting is allowed but only on the potion of land that will be used for agricultural production. In addition to these two main rules, communities in Nyimba also had a rule prohibiting dry season burning in forest areas.

Table 6. Market Access, Institutions, Rules, and Community Perceptions about Changes in Forest Outcome

District	Village/community	Access to market	Presence of forestry management programs in the last 10 years	Existence of local forestry management rules	Compliance with local forestry management rules	Level of enforcement and sanction of local forestry management rules	Forest outcomes
Mumbwa	Tumbama	Good	No	Yes (informal)	Low	Low	Negative
	Kabwanga	Poor	No	Yes (informal)	Low	Low	Negative
Kapiri Mposhi	Ndili	Good	No	Yes (informal)	Low	Low	Negative
	Green leaf	Good	No	Yes (informal)	Low	Low	Negative
Nyimba	Pondani	Good	Yes	Yes (currently informal, but drafting action plans)	Moderate	Low	Positive
	Lwembe	Poor	Yes	Yes (currently informal, but drafting action plans)	Moderate	Low	Positive
	Zubalinyenga	Good	Yes	Yes (currently informal, but drafting action plans)	Moderate	Low	Positive

Source: Authors' summary.

However, in all the seven FGD sites, there were no enforcement structures within communities to enforce these rules. As a result compliance by community members was low.

When asked why there were no enforcement structures, FGD participants explained that residents were not willing to be voluntary forest guards owing to the risk involved in conducting forestry patrols and arresting rule-breakers. In all the FGD sites, community members explained that rule-breakers are usually armed with dangerous weapons such as axes, and catapults, ready to defend themselves. This creates fear among community members who might be willing to take up the responsibility of forest guards. Another reason that community members are unwilling to be forest guards is the lack of incentives associated with being one. Discussants highlighted the fact that being a forest guard comes at a high opportunity cost, as one would have to spend time patrolling the forests when they should be engaging in other economic activities, including charcoal production itself.

FGDs and interviews also elicited information on the condition of local forests in the last 20 years. Three sites (Pondani, Lwembe, and Zubalinyenga) out of the seven FGD sites, all from Nyimba District, indicated that there was a positive change in forest conditions. However, it should be made clear here that these changes are based on community members' perception and no measurements were made to ascertain this. CIFOR has been providing forestry management extension, and helping with formalizing and amending the existing rules, and drafting local forestry action plans in these communities.

When asked whether the Forestry Department (FD) provides extension and training on forestry management, both FGDs and key informant interviews revealed that the FD mostly plays a policing role, rather than providing forest extension services. Lack of both human and financial resources was cited as the main reason for the FD's inability to provide extension services, and work closely with local communities.

The change was mainly in terms of forest regeneration, and not necessarily forest cover. When asked to explain what led to such an outcome, the respondents in these sites pointed out that the current process of formalizing and amending existing rules, which started two years ago, had helped improve compliance with some of the existing rules, such as not cutting down trees near streams/rivers and no dry season burning, among others. In addition, CIFOR has been educating these local communities on sustainable forestry management, which they indicated also helped improve compliance. A similar finding is reported in Dokken et al. (2014) in Tanzania, where the villages that reported improved forest cover and quality attributed this forest outcome to strong rules and conservation education.

An alternative explanation would be that conservation education increases participants' propensity to think that the local presence of forest conservation projects results in better conditions, which may or may not be true. Such perceptions may also be influenced by dominant narratives, as expectations of forestry management projects and conservation education are positive forest outcome. Particularly in group interviews, a narrative of improved forest outcome resulting from the forest management projects and conservation education may be a well-established narrative from both local and international sources. For this reason, members of the group may feel obliged to relate a story of change, even if they have not perceived any change in forest outcome.

During focus groups, participants indicated that communities that had good access to urban markets as proxied by distance to the nearest district center and/or main road had higher rates

of forest cover loss, with negative forest outcome. Focus group respondents narrated that access to markets creates incentives for local residents to engage in wood fuel business, as it implies low transaction costs of delivering the commodity to the market.

The above findings and discussions indicate that local forestry management institutions in customary areas in Zambia are significantly weak and unable to address the drivers of unsustainable wood fuel production and/or marketing. Generally, Zambia's customary land administration systems do not include clear and strong rules of local forestry management, and there is a complete lack of enforcement of the existing rules. Under such circumstances, open-access regimes, as is prevalent on customary lands in Zambia, are likely to cause rapid forest resource degradation and depletion, due to failure by existing institutions to internalize the costs of deforestation and forest degradation. Therefore, improving the local forestry management institutions and enforcement structures to be able to internalize the costs of deforestation and forest degradation has potential to contribute significantly towards reducing local forest loss and degradation (FAO 1998). A study by Vinya et al. (2011) on drivers of deforestation and the potential for REDD+ in Zambia, highlights among other conditions, the importance of ensuring effectiveness of local institutions, coupled with security of tenure as a way of encouraging sustainable local forest management by local users.

Although there might be variations in terms of land administration systems within the customary land tenure, and how they relate to forestry management, what appears to be emerging from our results and stakeholder interviews is that local forestry management in customary areas are informal, with very limited enforcement, resulting in failure to internalize the costs of deforestation and forest degradation. It is important to stress here that we did not attempt to understand the land administration and forestry management variations that exist across the customary land tenure system.

5.4. Contextualizing the IAD Framework

Following the IAD framework, human behavior and incentives are affected by socioeconomic and demographic factors, as well as institutions. The change in human behavior and incentives in turn impacts on local forest outcome. Our analyses has established that wood fuel participants are characterized by unfavourable socioeconomic attributes (poverty, low agricultural productivity, and low participation in output markets). In terms of demographic attributes, participants are generally younger males, with low education levels. Further, our econometric model results confirm that households with these attributes i.e., unfavorable socioeconomic attributes—young males with less education—are likely to participate in wood fuel production and/or marketing. The current lack of formal and effective local forestry management institutions acts as an impetus to drive participants towards unsustainable exploitation of forests—unsustainable wood fuel production in this case—as a means of off-setting their poor economic status. Where employment opportunities exist, there is potential for this labor to move towards such opportunities. However, the prevailing high unemployment rates in both rural and urban areas, coupled with the rising demand for wood fuel, create incentives for uncontrolled wood fuel production leading to deforestation and /or degradation (negative forest outcome).

6. CONCLUSIONS AND RECOMMENDATIONS

This study set out to identify some of the major household and community level drivers of wood fuel production and /or marketing, and explore and assess the existing local forestry management institutions under customary land tenure system. The identified household and community level determinants are mostly associated with poverty, unemployment, and rising demand for wood fuel, and wood fuel market access. With rural poverty rates of about 80% in Zambia (CSO/MAL/IAPRI 2012), high unemployment and the increasing demand for wood fuel, particularly charcoal in urban areas (Mwitwa and Makano 2012; GRZ and FAO 2009), wood fuel production and/or marketing will continue to rise. Our results agree with most studies in Zambia and other developing countries on the role of poverty as a driver of wood fuel production. Holding everything else constant, our results indicate that high landholding size, value of assets, and agricultural productivity reduce the likelihood of participation in wood fuel production and/or marketing.

Furthermore, our results also show that male headed households are more likely to participate in wood fuel production and/or marketing, perhaps due to the laborious nature of wood fuel production activities. With regards to institutions, our results indicate weak, and mostly informal local forestry management institutions in customary areas, with very limited enforcement, resulting in failure to internalize costs associated with forest depletion. The combination of weak institutions, poverty, unemployment, and rising demand for wood fuel, presents the forest (wood fuel) as an important alternative source of livelihood, leading to deforestation and degradation. Results from FGDs, key informant and in-depth interviews indicate that local forestry management institutions in their current state (informal rules, lack of enforcement structures) are not effective in dealing with rising wood fuel production and/or marketing. Although poverty, agricultural productivity, and unemployment feature prominently in forest conservation interventions, such interventions will have very limited impact on forest outcome if local forestry management institutions remain informal, with very limited enforcement.

Based on the major findings and conclusions drawn from the analyses we make the following recommendations:

- As local forestry management institutions play a crucial role in local forestry management, forest conservation strategies and programs need to facilitate formalization and strengthening of existing local forestry management institutions. This is in line with the revised national Forestry Policy of 2014 which prioritizes the establishment of a framework that supports traditional leadership and communities to develop local level rules and regulations to facilitate effective management of forest resources. Based on local perceptions, the intervention by CIFOR in Nyimba District to provide forest conservation and management education, and helping local communities formalize, amend, and enforce locally designed rules appears to be improving local forest conditions.
- Rural development strategies need to ramp up rural employment creation to help shift labor away from wood fuel production and/or marketing. As in many other African countries, Zambia is experiencing rapid youth population growth *youth bulge.* Many of these young people will be seeking employment or business opportunities. However, in the absence of such opportunities, wood fuel and mostly charcoal, will most likely remain one of the important sources of livelihood for the majority rural youth. This will have far-reaching environmental consequences as it implies more people getting involved in wood fuel production and marketing with a resultant increase in deforestation/degradation rate.

With the support of FD, customary land administrators and their communities should formalize, and where necessary, amend the existing rules to respond to emerging economic and structural changes, such as rising urban demand for charcoal, rural population growth, unemployment, and poverty. As wood fuel continues to be an important source of income and energy for most rural households, establishment of community woodlots is an option worth exploring. However, it is important to first understand the institutional, financial, and technical requirements are needed to sustainably manage such woodlots.

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